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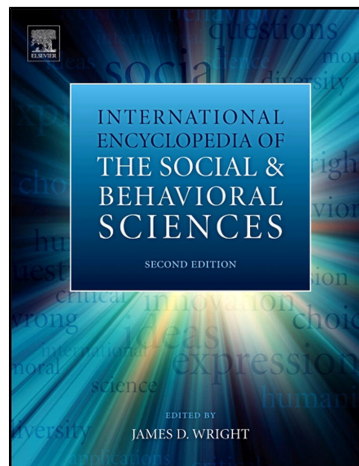
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Cooperation: Sociological Aspects

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Abstract

The most prominent studies of cooperation in sociology proceed from some kind of rationality assumption. There are basically two groups of studies, one starting from the assumption of rational egoism and the other starting from the assumption of social rationality, in which other regard has a prominent place. The studies based on the assumption of rational egoists are strongly inspired by (mostly game-theoretical) developments in economics and political science, but add important sociological aspects to the analysis. Most important among these contributions are the dynamic analysis of cooperation, the link between formal and informal institutions, and the importance of social networks for embedding problematic transactions. Studies based on social rationality introduce assumptions on social preferences, learning, and framing. Important questions concern the circumstances that strengthen or weaken social preferences, the evolution of signals and conventions that govern trust, and the effects of goals on the definition of the situation. Studies using social rationality are on the rise.

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Individuals cooperate if each willingly acts in a manner that contributes to the other's welfare. Cooperation is one of the oldest and most revered topics in sociology, even though it has appeared under a variety of headings, such as 'social order' and 'solidarity.' The classical sociological answers to the question of how cooperation among individuals comes about differ in detail but share a common core: Cooperation is the result of shared values and norms and norm-conforming behavior.

A problem with this 'obligation-centered' solution is that there is no explanation of where norms come from and why the degree of norm conformity varies even for the same individual over time. Theories that might solve these problems were not developed until the 1970s, when a sea change in the basic assumptions on human action took place within sociology. At that time, analyses of cooperation among rational egoists (mostly rooted in game theory) began to shed new light on the way one might analyze cooperation, norms, and norm-conforming behavior. For some time, game-theoretic analyses of cooperation had become the most serious attempt to explain

cooperation. Big advances were made but many problems remained, especially the problem that individuals do not seem to be as self-centered as they are assumed to be in game theory. Still, the game-theoretic analyses were powerful enough to suggest that there was no way back to explanations of cooperation that ignored human rationality all together. More recently, analyses based on some form of social rationality have arisen in order to address some of the unsolved problems. The following sections first present the most important aspects of sociological research on cooperation among rational egoists, and then discusses some contributions on cooperation with social rationality.

Cooperation Among Rational Egoists

It may not be quite realistic to assume that individuals are always looking out for themselves and that they do so by weighing the costs and benefits of their behavior. However, this assumption of 'rational egoism' seems to have four strong points in its favor. First, it allows one to pinpoint why cooperation is an interesting problem. Second, it allows rigorous theory formation with tractable structures of argumentation. Third, everyday experience and research give this assumption enough support to make it worthwhile to use it in the light of its analytic advantages, especially when analyzing interaction among interdependent individuals. Fourth, at later stages of theory formation, this assumption can be relaxed in favor of more realistic assumptions.

Game theory has furnished the most important instruments for such analyses, and since the late 1970s – inspired by developments in political science and economics – sociologists have begun to use it to study questions concerning cooperation, typically bringing sociological aspects into the analyses, such as network embedding. The crucial first step in the 'new' analysis was to identify typical situations in which cooperation is problematic: social dilemmas. A social dilemma is – roughly speaking – a situation in which the rational decisions of

individual actors are likely to lead to a collectively suboptimal outcome. An outcome is suboptimal (i.e., not 'Pareto-optimal') if one or more actors could improve their position without worsening the position of any other actors. In a social dilemma, individual and collective rationalities are in conflict. Cooperation can now be succinctly defined: An actor cooperates if and only if he or she chooses a course of action that will lead to a collectively rational outcome when other actors behave cooperatively as well. Social dilemmas occur when Pareto-superior behavior cannot be achieved by enforceable contracts. This may have many different reasons. For example, it may be impossible to communicate with others in order to come to an agreement; or, if communication is possible, transaction costs may be too high to actually reach an agreement. If agreements are within reach, it may be practically or epistemically impossible to specify all relevant future contingencies in the contract. Even if a contract can be drawn up, there may be no court with sanctioning power; or if there is such a court, it may not be possible to prove uncooperative behavior in court.

There are structurally different variants of social dilemmas, and game theory helps to distinguish them. For example, there is the common's dilemma (Hardin, 1968; Ostrom, 1990) in which various actors have free access to a resource (such as fishers from different nations in international waters); there are step-level public goods (Taylor, 1987), for which only a limited number of actors have to cooperate in order to produce the public good for a much larger group. A special case of this is the volunteer's dilemma (Diekmann, 1985), for which only one volunteer is necessary to produce the public good for all, such as rescuing a drowning child with a crowd of onlookers; there is the trust game (Dasgupta, 1988) in which the trustee can honor or opportunistically exploit the cooperation of the other (as when you lend money to an acquaintance who promises to pay it back with interest).

The prisoner's dilemma (PD) is by far the best-known variant of a social dilemma. It involves an arbitrarily large number of people. The special case of a two-person PD has been explored the best so far. In a two-person PD, both players have the option to cooperate or to defect (Figure 1). If both cooperate, each gets a payoff of value R . If one defects while the other cooperates, the defector gets T and the cooperator gets S . If both defect, both will get P , with $T > R > P > S$. There is a dominant strategy for each player (i.e., an individually rational choice, no matter what the other does) leading to a 'Nash equilibrium' (in which no player can unilaterally improve his or her position by deviating from the equilibrium strategy) and

	C	D
C	R, R	S, T
D	T, S	P, P

Figure 1 Prisoner's dilemma game. In the Axelrod simulation is T (temptation) = 5, R (reward) = 3, P (punishment) = 1, and S (sucker's payoff) = 0.

to a Pareto-inferior result. The assumption of rational egoism leads to two motives in a PD: the defensive motive to shield against exploitation (if the other defects you are better off defecting yourself), and the aggressive motive to exploit a cooperative player (if the other cooperates, you get even more by defecting). Together, these motives result in the conflict between individual and collective rationality. Mutual cooperation would be the Pareto-optimal result, but the two motives lead to mutual defection.

The Embedding of Cooperation

Raub and Weesie (2000) have suggested that game-theoretic work on solutions to social dilemmas can be divided into three kinds of embeddings of potential cooperation: embedding in time, in institutions, and in social networks. We follow their suggestion for this overview.

Time

When actors find themselves in a social dilemma that is iterated indefinitely over time, new sources for cooperation arise. First of all, defection can be sanctioned by the other players in later moves, and the resumption of cooperation by the defector can be rewarded by a similar response of the other players. Friedman (1977) and Taylor (1987) have shown that if the value of future outcomes is high enough, this opportunity to make one's cooperation conditional on that of the other leads to cooperative strategies with Nash equilibrium and Pareto optimality. Axelrod (1984) built on this result to ask the question of which strategy would be most conducive to lead to cooperation in an iterated PD. In order to answer this question, he conducted computer simulations in which various strategies played against each other for about 200 rounds. Axelrod had invited suggestions for the strategies that would create the most cooperation. The winner was the conditional strategy 'tit for tat' (TFT) suggested by the mathematician and psychologist Anatol Rapoport who gained his insight from early experimental studies with the repeated PD (Rapoport and Chammah, 1965).

TFT is very simple: (1) always begin with cooperation; (2) for the present round, copy the move of your partner in the previous round. TFT has a number of distinct features. It is 'nice,' because it starts with cooperation; it cannot be provoked, because it sanctions exploitation; and it is forgiving, because it returns to cooperation after the other has done so. Contrast this, for example, with 'permanent retaliation' in which defection is answered by unforgiving defection, a strategy that did much worse than TFT. It does not do well against all sorts of strategies and it does not respond optimally to mistakes that might occur with small probability (Nowak, 2012).

The heart of Axelrod's results, however, is thoroughly in line with a classical sociological insight: that the norm of reciprocity is probably the most essential norm generating cooperation in time-embedded interactions. As sociologists have argued for quite some time, homogeneity of a group in terms of important characteristics (including the use of 'nice' strategies) will increase the likelihood of reciprocity, as does smallness of the group because it helps identification of defection. Similarly, a low rate of fluctuation of membership helps reciprocity because it increases the shadow of the future.

A related argument has been made in terms of 'social capital' (Coleman, 1990).

Axelrod's tournament was based on the opportunity for 'direct reciprocity' among two actors. In larger groups, a system of cooperation may emerge because of 'indirect reciprocity.' In such a system A's cooperative decision in favor of B is not rewarded directly by B but by some other actor observing A's helpful act. Provided that cooperative acts increase an actor's reputation score, the possibility of indirect reciprocity leads, under certain conditions, to a stable state of cooperation (Nowak, 2012). Not formally proved systems of direct and indirect reciprocity had already been explored by classical sociologists and anthropologists decades ago (Blau, 1964), but modern game theory and agent-based simulation methods help to find out the conditions for the evolution and stability of cooperative systems.

Institutions

When reciprocity norms work, they are self-enforcing because no player can do better by unilaterally deviating from the cooperative strategy (Nash equilibrium). However, under many conditions, norms of reciprocity will not work properly. For example, when future contingencies are so complex that it is difficult to determine a priori what constitutes defection or difficult to detect defection, a reciprocity norm is not enough to secure cooperation. Similarly, such self-enforcing norms do not work well for the production of collective goods in larger groups, the less so the more inhomogeneous and fluctuating the group membership. In such situations, expectations concerning the relative importance of one's own and others' contribution are likely to be low and individuals tend to free ride rather than to contribute to the production of the collective good.

When self-enforcing norms do not work, cooperation may be achieved by embedding interactions in formal or informal rules that create 'selective incentives'; that is, added rewards for cooperating and punishments for not cooperating. This argument was first forcefully made by Olson (1965) and has been refined by sociologists and other social scientists (e.g., Hechter, 1987; Marwell and Oliver, 1993; Ostrom, 1990). For example, the state punishes tax evasion and provides some standard instruments for contracting; in many countries, labor unions offer extra benefits (such as cheaper insurance) for joining the labor union. The formation of institutional solutions has been explained by Hechter (1987) as a two-stage process. First, groups for the joint production of private goods are established (such as insurance). They are small enough that noncooperators can be detected and excluded (hence no free rider problem). The profits made from the joint production can then be used to establish selective incentives for the joint production of collective goods. In this way, labor unions may emerge from mutual insurance groups. Abell (1996) adds to this kind of analysis that a proper institutional explanation of cooperation should include the explanation of how cooperation can be combined with rivalry and competition. More work in this direction is needed.

Williamson (1985) has pointed to the importance of 'private orderings' in which, in the shadow of the law, contract partners may voluntarily restrict their own options, thereby creating selective incentives for their own cooperative action. For the partner, such measures work if there are 'credible commitments,' for example, by posted hostages and granted

warranties. Sociologists have used this idea successfully to study contractual behavior (e.g., Weesie et al., 1998).

Often, credible commitments are difficult to establish (due to the size of the group) and formal institutional arrangements (with enforced sanctions) may not be available. In such groups, informal rules (social norms) that govern selective incentives for cooperation are needed. Like all rules, informal rules work only if they are enforced, and this creates the second-order free rider problem. Sanctioning noncooperators is itself a (step-level) collective good. There seems to be an infinite regress. How do groups get out of this problem? There is no handy solution to this problem within the rational egoistic approach, although suggestions were put forward recently (Raihani and Bshary, 2011; Przepiorka and Diekmann, 2013). However, as Heckathorn (1996), following Marwell and Oliver, has shown, public good production is not always subject to the first- and second-order free rider problems. In fact, the production function (i.e., the function that relates the proportion of cooperators to the level of the public good production) is likely to be S-shaped and only for certain values of the function will the situation have the structure of a PD. The reason for this is that an S-shaped production function implies a changing marginal utility from cooperation as the proportion of cooperators increases. Interestingly, Heckathorn also found that in certain phases 'hypo-critical cooperation,' in which people criticize others for not cooperating even though they do not cooperate themselves, is quite effective in eliciting contributions to the collective good (Yamagishi, 1986). The main lesson to be learned from Heckathorn's analysis is that collective action should be analyzed dynamically, a conclusion one can also draw from Hechter's analysis of institutional controls mentioned above.

Social Networks

It has long been known in sociology that it often matters to people what other people say about them. Cooperation is helped by the effects of reputation within networks. For example, DiMaggio and Louch (1998) found in a national sample that consumers, when they are uncertain about products and performance, prefer to buy goods and services from suppliers with whom they have social ties outside the transaction itself. If the suppliers in such a network are clearly unreliable, the consumers are likely to have heard about it. If these suppliers begin to be unreliable, the network relations can be turned against them. Thus, networks have an information function (people learn about the cooperativeness of certain others) and a control function (people can use the network to sanction noncooperators).

Both aspects have been worked out game-theoretically by Buskens and Raub (2013). For dyadic transactions, characteristics of the network (such as density, 'indegree,' and 'out-degree'; that is, the number of others with whom people are connected) play an important role but it turns out that reputation effects are quite complex and there are indications that they might be less important than the temporal embeddedness. For economic transactions, Uzzi (1996) has found interesting additional effects of networks on tacit knowledge and joint problem solving. Network embeddedness for collective action has apparently not been studied yet in any rigorous way.

Yet another use of networks for the explanation of cooperation has been suggested by Coleman (1990). He points to the

importance of intermediaries for the creation of trust and thus for cooperation. Intermediaries can play a number of roles: as advisors who introduce interested parties and facilitate the interaction necessary to create trust; as guarantors who absorb the risk if trust turns out to be misplaced; and as entrepreneurs who combine the resources of several actors to place them into the hands of others who are expected to realize gains. For future research, a sociologically interesting question is under what conditions will structures with certain kinds of intermediaries emerge.

Cooperation Among Socially Rational Individuals

There is a growing sociological literature on cooperation that holds on to the assumption of rational action but adds specific 'bridge theories' on preferences, learning, and framing, the effect of which is to render regard for others quite prominent in the analyses. Rationality is seen as having evolved together with the ability to derive adaptive advantages from living in groups (Dunbar, 2003). Hence the term social rationality. Preferences are likely to have been influenced by this process, and the social influence on cognitive and motivational processes may even create situationally different kinds of rationality. In this literature the trade-off between empirical richness and analytical tractability is different than in most game-theoretic analyses. In the latter, added analytical power and tractability is often achieved by the rational egoist assumption at the expense of some loss in closeness to reality, whereas in the former, some analytical power and tractability is sacrificed in favor of added closeness to reality. Clearly, each kind of approach profits from the existence of the other. In this review, there remains room for the discussion of only a few developments.

Goals (Preferences)

By far the largest amount of literature on cooperation in the 'social rationality' category is concerned with 'social preferences.' Although the term preference is often used in this context, a better term would be 'social goals.' One variant of this approach, found in social-psychological and sociological research, is 'social orientation' research, in which individuals are differentiated according to their orientation toward others. This orientation is often assumed to be more or less stable and the joint result of nature and nurture. Different types of orientation are distinguished, most frequently the following three: 'cooperative' (the goal is to maximize joint payoffs); 'individualistic' (the goal is to maximize individual payoff); and 'competitive' (the goal is to maximize the positive difference between own and other's payoff). Such 'types' can be combined with game-theoretic analyses or with analyses of evolutionary learning at the population level.

A related but different approach emphasizes that human beings have evolved to have (pro)social goals that make them dependent on others and thus willing to cooperate for a variety of reasons. This concerns mainly the value of status (leading to cooperation by the strategic adaptation to authority relations, or to lack of cooperation due to status competition), the value of behavioral confirmation (leading to cooperation on the basis of conformity to peers' expectations), and the value of

affection (leading to cooperation on the basis of liking) (Lindenberg and Frey, 1993).

Importantly, cooperation also depends on negative goals, especially the desire to punish noncooperators. An influential experiment by Fehr and Gächter (2002) demonstrates that subjects punish free riders in collective good situations even if sanctioning is costly. This type of behavior is called 'altruistic reciprocity.' Actors pay a price for negatively reciprocating to noncooperative behavior, thereby sustaining cooperation in a public good situation. Having the choice between a regime with sanction-free and sanctioning institutions in a collective good situation, most subjects chose the former in the beginning. However, after the breakdown of cooperation under the sanction-free regime, subjects increasingly change to the alternative regime. This experiment by Gürerk et al. (2006) exhibits that sanctioning institutions solving the problem of cooperation emerge in a dynamic, evolutionary process. Yet, on a societal level, the willingness to engage in costly punishing varies considerably among different cultures and countries (Henrich et al., 2006).

Sociologists and economists who focus on different types of people (in terms of orientation) are especially concerned with questions of signaling and the spread of strategies over time, some of them using genetic algorithms taken from evolutionary biology. This makes trust a central concept in the analysis of cooperation. For example: "Are the tendencies to trust and to honor trust correlated?" (Snijders, 1996); "How can cooperative types convincingly signal their type to others so that they will be trusted and cooperation comes about?" (Posner, 2000). Or "Under what conditions will effective rules for trusting (i.e., conventions for detecting cooperators) evolve in neighborhood interactions and spread across the population through contact with strangers?" (Macy and Skvoretz, 1998). One problem with this concept of social orientation is that it does not allow for situational influences on preferences and cognitions. Could not there be situations in which one is prosocial and others in which one would be quite egoistic?

Framing Effects

The willingness to cooperate seems also to depend on how people define a situation. Of particular importance is the difference between gains and losses. Kahneman and Tversky have shown that individuals are keener on avoiding losses than on achieving gains, *ceteris paribus*. This leads to the hypothesis that it is easier to bring about cooperation concerning the defense of a common pool resource than the achievement of a (new) public good. For example, it should be easier to bring about a campaign to preserve a rainforest than a campaign to create a wildlife preserve. The evidence for this is somewhat mixed (Van Assen, 1999), but when the disturbing effects are carefully controlled, the framing prediction finds support, especially for initial stages of cooperation (Sell and Son, 1997). There is also a claim that people often cognitively transform a PD into a game with conditional cooperation (assurance game). The interesting question then is how the beliefs that others will cooperate are influenced by social circumstances or by cultural beliefs (Hayashi et al., 1999), and what influence certain thresholds of cooperation have for triggering conditional cooperation in a larger group (Yamaguchi, 2000).

A different framing effect comes from 'goal framing' (Lindenberg and Steg, 2007). Overarching goals have a strong impact on the way individuals define a situation and thereby create a difference between 'foreground' and 'background' information and preferences. What is in the foreground will have a much stronger impact on behavior than what is in the background, *ceteris paribus*. For example, if the overarching goal (the goal frame) 'to act appropriately' is salient, then information on normative expectations and ways to meet them are in the foreground and in the center of attention, whereas the overarching gain goal 'to increase and guard one's resources' is in the background. As a result, when the goal-frame is normative (i.e., the goal to act appropriately is salient), orientation toward common goals and norms is focal and costs of cooperation are much less prominently perceived. Costs of cooperation must then be much larger in order to reduce people's willingness to cooperate than when gain itself is the goal frame. Sociologically, an important feature of overarching goals is that people are likely to signal their goal-frame to others through their behavior (e.g., through 'relational signals'), creating contagion effects that make (non)cooperation spread. The cooperative orientation linked to the normative goal-frame seems to be triggered especially when others show concern for norms and also when the situation is clearly one of reaching a common goal ('joint production,' Lindenberg and Foss, 2011). Group identity processes also play an important role (Simpson and Macy, 2004). All this puts a high premium on including cues that signal goal-frames (prominently including symbolic behavior) in the analyses of cooperation, even in game-theoretic analyses, and in the analysis of how institutions work to foster cooperation.

All in all, in sociology, studies on cooperation are both based on the assumption of rational egoists and on some kind of social rationality. The latter are clearly on the rise in number and sophistication.

See also: Affect-Regulation Motivation; Cooperation and Competition; Decision and Choice: Bounded Rationality; Dispute Resolutions in Economics; Emotions, Sociology of; Game Theory: Noncooperative Games; Game Theory; Groups, Sociology of; Institutions; Network Analysis; Norms; Organizational Decision Making; Organizations, Sociology of; Prisoner's Dilemma, One Shot and Iterated; Psychoanalysis in Sociology; Rationality in Society; Social Relationships in Adulthood; Solidarity, Sociology of; Trust, Sociology of.

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